Wolf Survey in the Nisutlin River Basin, February, 2011

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Derek Drinnan with Supercub "Foxtrot India November Sierra"

Cover photo: Nisutlin River pack 11 members.

Acknowledgments

I would like to thank pilot Derek Drinnan of Blacksheep Aviation for performing the flying as well as for contributing his substantial wolf tracking expertise. Thanks also to wildlife technician Kieran O'Donovan, who flew the last day of survey under extremely cold conditions and did it with a grin. Gratitude is also extended to the Teslin T'lingit Council as their funding contribution made this survey possible

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Summary

- The 2011 Nisutlin Basin wolf survey was flown February 5–18, 2011. Survey conditions were good, with adequate snowfall and generally calm winds. Survey coverage rate was 31 minutes per 100 km^2.
- The wolf population was within normal population parameters when compared to Yukon averages.
- We found 14 packs resident in the area, with an average pack size of 6.4 wolves per pack. The number of packs translates into an average of 1.22 packs per 1,000 km^2. The wolf population estimate was 98 wolves or 8.6 wolves per 1,000 km ^{2}.
- The average pack size and wolf population density estimates were typical of many wolf populations surveyed in Yukon between 1984 and 2011. Pack density was slightly higher than the Yukon average.
- The 3 packs with the highest pack memberships occupied the areas where moose appear to be most concentrated in late winter.

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Introduction

Why we did the survey

Over the last few years Environment Yukon and the community of Teslin (as represented by the Teslin T'lingit Council and the Teslin Renewable Resources Council) have been in discussions about wolves and the potential impacts of wolves on what the community feels is a declining or low density moose population in the Nisutlin River area. The community has increasingly expressed concerns about moose and the need to limit wolves as predators of moose.

An updated wolf population status for the Nisutlin River area was needed in advance of any discussions possibly leading to recommendations on moose recovery plans. The 2011 population survey was also an express wish of the Teslin T'lingit Council which provided significant financial support for the survey.

The only prior wolf census in the area was done in 1987. A moose survey completed in this area in December 2010 contributed to the timeliness of this survey (Westover et al. In prep.).

The purpose of this survey was to

- document wolf numbers;
- determine pack distribution; and
- evaluate wolf density over the study area.

The survey area

The 2011 Nisutlin River Basin wolf survey area covered an area of approximately 11,450 km2 and included most of the watersheds of both the Nisutlin and Wolf rivers and encompassed the 5,083 km2 1987 survey area (Figure 1).

The Yukon/ B.C. border and Teslin Lake defined the southern survey limit while the watersheds of the Nisutlin and Wolf rivers defined the remaining survey boundaries.

We defined the survey area so that it had the smallest perimeter possible for the amount of land surveyed. Major watershed boundaries and large lakes are desirable study area boundaries because they often also act as natural pack boundaries. We felt this would help minimize the problem of wolf territories being bisected by the survey area boundary.

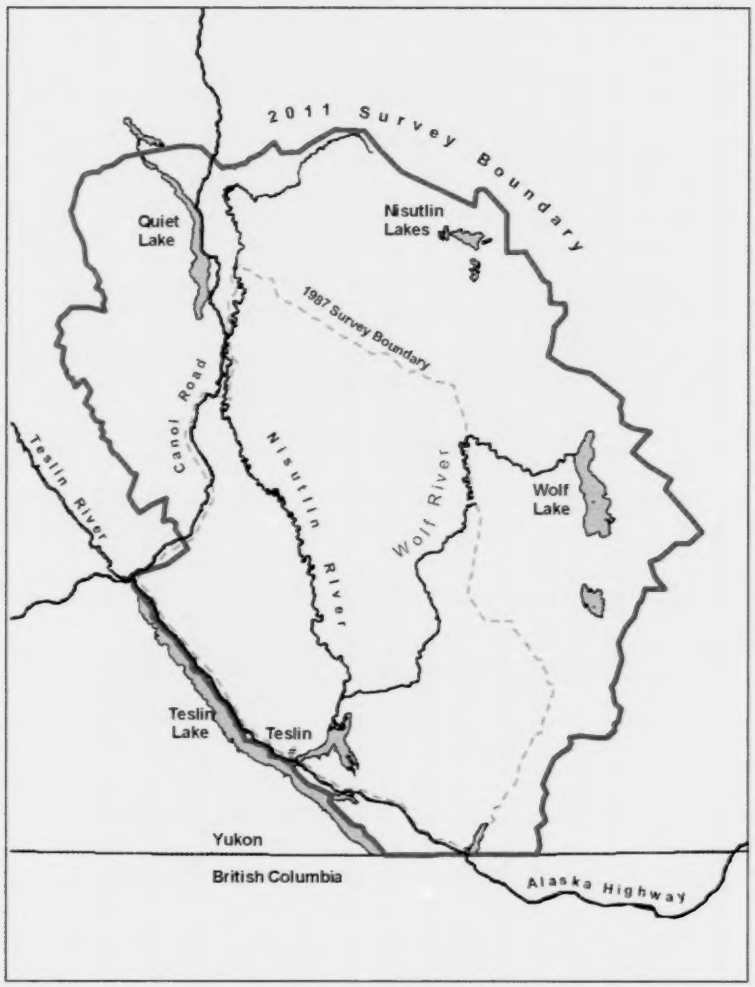


Figure 1. Nisutlin River Basin wolf survey area in 2011 with 1987 survey area noted.

Methods

Survey timing

We flew 59.1 hours on survey February 5 –18, 2011. We planned to fly twice a day but marginal weather on 3 of the 11 operational days restricted us to a single flight. Weather prevented us from flying on February 9, 10, and 14. All flights originated in Teslin (Appendix 1).

Survey Aircraft

All flights were made in a PA-18 Supercub aircraft. This is a high wing style aircraft with room for only a pilot and 1 observer. The observer sits behind

the pilot and both crew members can look out either side of the plane. The Supercub can fly and circle very slowly, and allows for very good visibility to either side and below the aircraft making it the ideal airplane for wolf tracking.

Estimating Wolf Numbers

Standard technique

The standard wolf survey method used in Yukon is a minimum count aerial snow-tracking method. This technique is designed to identify packs and estimate membership. A pack is any group of 2 or more wolves. Snow tracking of lone wolves is not done because they do not hold territories. Lone wolves are included in the population estimate by adding 10% to the territorial pack population.

Wolf trails are located and followed from the air until wolves are seen or the trails are erased by drifting snow, or lost in rocky high mountain terrain; caribou winter range, or extensive forest cover. Our flight lines usually followed meadows, lake margins, watercourses, open forests, and ridges, because it is easiest to intersect track sign in these terrain types.

The snow track count provides a minimum count of pack wolves based on track sign or actually seeing and counting the wolves. When pack wolves travel in winter they usually move single file until they come to a shallow snow area such as overflow on river ice, when they tend to spread out, each on its own trail. These splits in the trail form the basis of the minimum count.

An estimate of the maximum numbers is based on "trail splits" where it is felt more than one individual has shared a "split" and thus 2 or perhaps 3 animals are in one of the split trails.

In many areas of Yukon, where weather fronts are stable and suitable flying conditions persist for many days, snow tracking is attempted about 3 days after a 5–10 cm snowfall. This timing allows packs to lay down enough track sign for us to find it while flying a single pass through an area. It is best to finish the survey before late February and the onset of breeding season. Social stress due to breeding can cause temporary pack splitting to occur. Some members, including the breeding pair, may separate from the main group for several weeks before rejoining the main pack.

The survey is completed within the shortest time possible to make sure any packs that might make long-distance moves are not counted twice. The usual survey technique is to fly consecutive days until the survey is completed, usually within a week of starting. The survey area is covered completely only once.

Technique modifications used in this survey

A modification of the standard survey technique was used in the Nisutlin survey to suit the terrain and the wolf activity patterns we encountered.

Our flights above 3500 ft (1075 m) found almost no sign of either ungulates or wolves (Appendix 2). Mid-winter snow accumulations in the Nisutlin Basin had forced moose and caribou to migrate to lower elevations, where they were associated with a mix of high forest cover and open riparian habitats along the major rivers and creeks. This movement caused wolves to concentrate their hunting activities and travel routes in these areas as well.

Heavy timber in many of the river valleys made it difficult to track long segments of wolf trail when they moved off river to hunt. However, wolves remained active in the open areas close to the river channels and travelled the river or creek ice frequently, so a chronological sequence of wolf track sign was built up along the open areas during the 14-day survey period.

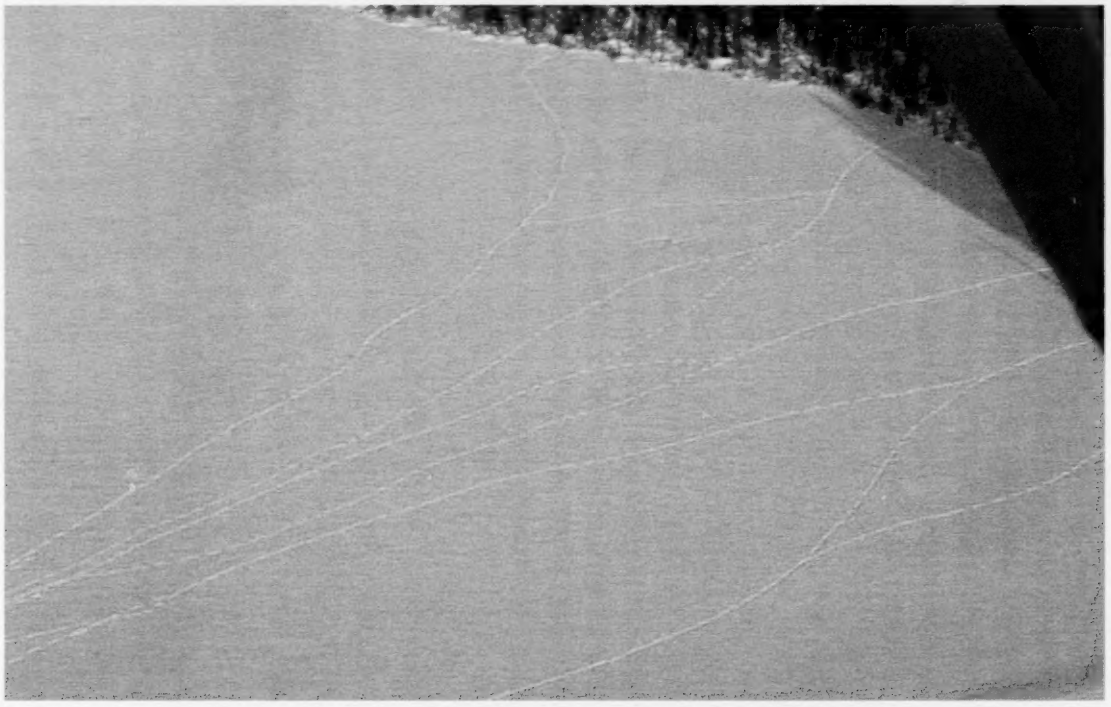


Figure 2. When pack wolves travel in winter they usually move single file until they come to a shallow snow area when they tend to spread out. There are a minimum of 10 wolves counted in this trail split of the Wolf River pack.

We made repeated visits to open areas along the rivers, creeks, and ponds where we had previously identified wolf activity and mapped the fresh

track sequences as they occurred. This created a very clear chronological sequence of tracks that allowed us to figure out which packs were operating in which areas. The ability to sort out tracks based on timing of occurrence was important because several packs had instances of overlapping activities in territorial boundary areas and were separated from each other by time rather than distance. An example of this issue was on the Nisutlin River where we were able to separate track sign on one section of river into 2 packs, one group of 5, and another group of 3. Our initial flight assessment had been that there were 8 wolves in one pack.

Our efforts to revisit known activity areas and catalogue fresh sign over a period of days provided visual contact with 70% of the packs identified, which helped validate our pack assignments built up over the course of the survey. We were able to use colour differences to identify and separate several packs that were of similar size and operating near each other.

In the case of 2 packs operating near the community of Teslin we confirmed our snow track data with public sighting information which gave us pack colours and confirmed pack size.

Total wolf population size was derived by adding 10% to the pack population totals to account for the number of lone wolves in the area. The actual proportion of "loners" in a population may vary considerably, and likely increases in lower density wolf populations, but cannot be precisely determined without more intensive methods involving radio collaring wolves. In our experience adding 10% to the pack population to account for lone wolves in the area is reasonable and has been used as the benchmark in all previous Yukon surveys. The population estimate is presented as the rounded off even number midpoint of the minimum and maximum estimates.

Results and discussion

Nisutlin and Wolf River 2011 wolf population estimate

We located 14 packs with an estimated 87 to 91 members in the study area (Table 1). When we added 10% to the number of pack wolves to account for lone wolves, the total wolf population was 98 wolves (range 95.7 to 100.1).

The 2011 survey results provide a mean pack size estimate of 6.4 wolves per pack, with the population density being 8.6 wolves per 1,000 km2, (range 8.4–8.7). Pack density was 1.22 packs per 1,000 km2.

The relatively high pack density coupled with only average pack size which indicates that there is room for this population to respond quickly to increases in moose density. The combination of high pack density and an

increasing average pack size resulting from any increased ungulate density would likely exert limiting effects on ungulate population growth.

We did not count moose during this survey as a major census had already occurred during December 2010. During the survey only 7 kills were located, all of which were moose.

How accurate was the survey?

The two most important requirements of the snow-tracking method are: 1) ensuring the complete area is searched, and 2) knowing that packs are not missed or counted twice.

Table 1. Wolf packs surveyed in February 2011, Nisutlin River Basin Wolf River Survey Area.

Wolf packs	Minimum	Maximum	Source *
Teslin Town	3	3	P,T,V
Deadman Creek	2	2	P,T,V
Nisutlin Bay	12	12	V,T
Wolf River	11	11	V,T
Morley River	4	4	V,T,P
Nisutlin River	11	11	V,T
Evelyn Creek	5	6	V,T
Sydney Creek	3	3	T
Big Bend	8	10	T
Hundred Mile Creek	6	6	V,T
Rose Creek	6	6	V,T
Wolf Lake	6	6	T
Wolf Lake Burn	2	2	V,T
Big Lake	6	6	V,T
Total Pack Wolves	**87**	**91**	

* V – Visual, T - track sign, P- Public or ground observation

The rate of coverage for this survey was more intensive than the Yukon average but less than that of the 1987 Nisutlin survey. We dedicated 31 minutes to search each 100 km2 in 2011 compared to 45 minutes per 100 km2 in 1987. The Yukon average coverage rate is 22 minutes per 100 km2 block. We are confident that the area was well covered. We were able to fly under favourable weather conditions with calm to light winds and generally sunny conditions on almost all days when we flew.

The favourable conditions allowed us to maintain almost daily flights and stay in close proximity to wolf activity as it was discovered. We could record new sign without having to estimate its age. The repeated visits to areas of recent activity also increased our chances of seeing the wolves and gave us a better understanding of each pack's operating area. The colour groupings identified for different packs also allowed us to differentiate similar packs that were close together, so we were confident we did not count any packs twice. We saw 8 of the 12 packs that were in the core of the

survey area and the 2 packs near Teslin (Teslin Town and Deadman Creek) were seen by residents.

The average pack territory size in Yukon is about 1,000 km2 so we assigned a 1,000 km2 area circle to each pack we encountered (Appendix 3). Although not useful for actually defining territories, these circles allowed us to roughly estimate any voids in track sign where undetected packs might be operating and then increase our search effort in those areas if necessary. There was a potential void east of the Wolf River pack, but the area was mainly over 3500 feet and moose and caribou sign was almost completely absent.

We are confident that we found the main areas of wolf activity in the survey area based on track sign, and that our assignments of this track sign to the correct packs was valid. We covered the area extensively (Appendix 4) and because there was almost no sign above 3500 feet were able to focus more time on the lower elevation areas where wolves were operating. The only reservation is that we did not see the Big Bend pack or detect any of its fresh sign. The tracks of this pack up and down the upper Nisutlin River was several weeks old when the survey began, and although it may have been operating in an area heavily used by caribou in the Hundred Mile Creek area, we would be more comfortable if we had encountered fresh sign from this group. It is therefore possible that this pack was outside the survey area during the survey, or we in fact double counted the Hundred Mile Creek pack or the Rose Creek pack. However, we included the Big Bend pack in the census as a separate pack because the track sign showed it to be 8 and likely 10 members strong within a few weeks of the survey starting. Our sightings of the Hundred Mile Creek pack and the Rose Creek pack were thorough enough to conclude that they both had 6 members.

Survey area size differences with resident and non resident packs.

When a survey area boundary is superimposed over any given land area we can assume that there are some wolf pack territories that are intersected by the survey boundary line. Any wolf pack territory intersected by the line will have either a majority or a minority of its area within the survey area.

The assumption made is that for every pack considered to be a resident of the survey area (more than half its territory is inside) there will be a pack that is not resident (more than half its territory is outside). The 2 sets of conditions are assumed to cancel each other out and make the density estimate reasonable because the chances of counting a non resident pack as "in" when it is not resident are the same as missing a pack that is resident but currently outside during the survey. This "cancellation effect" also assumes that all packs that are inside the survey area at the time of survey will be counted only once and none will be missed.

The smaller the area surveyed the fewer packs involved in the census and the greater the proportion of packs in the survey that will have territory cut by the survey boundary. Any density estimate error that results from double counting or missing packs, or from when the "cancellation effect" does not hold true, is amplified as the number of packs in the survey declines. As an example, if there are 4 resident packs in an area and one is missed the estimate will be down by 33%. If all 4 resident packs are counted but there is one extra non resident pack inside the area that gets counted then the estimate will be inflated by 20%. If there are 10 resident packs in an area and one is missed or an extra non-resident pack is found inside the area the error would be down 11% (9 packs counted) or inflated by 9% (11 packs counted) respectively.

When Yukon wolf survey areas are filtered by size, the difference in survey results based on the size of the area becomes noticeable. Small area surveys tend to inflate wolf population estimates relative to larger areas (Table 2). Whenever possible we try to use 10,000 km2 as a cut off for doing surveys as this is a good compromise point between the reality of budgetary restraints for too large an area and less reliable estimates in the smaller areas.

Table 2. Wolf population averages based on Yukon survey areas being greater or less than 10,000 km2.

	Number of surveys	***Average Area surveyed***	***Mean Pack Size***	***Wolves per 1,000 km2***	***Pack density***
Surveys over 10,000 km^2	16	16,465	*6.3*	*7.3*	*1.07*
Surveys less than 10,000 km^2	13	6,823	*6.0*	*8.8*	*1.26*
Small areas are...		**60% smaller**	***5% smaller***	***21% larger***	***20% larger***

Frequently, areas where wolf surveys are done have been selected because of a management interest in ungulate populations. If these areas are sufficiently large, the inflation of estimated wolf numbers can be minimized. In contrast, a small survey area centred on an area where moose are concentrated in late winter will tend to result in an inflated estimate. Any wolf packs with even a small portion of territory within this moose concentration area will likely be counted during the survey because they will be most active where the moose are most plentiful. Thus the "cancellation effect" is likely to fail, as all packs with any territory at all in the study area are going to be active near the moose concentration area, resident and non resident alike.

Nisutlin Basin wolf surveys 2011 and 1987

We think that the 2011 wolf survey presents an accurate picture of the current wolf population status in the Nisutlin Basin while the data from the 1987 survey are compromised by the small area surveyed.

In regions of Yukon where mountainous terrain creates snow conditions that force moose onto restricted winter ranges in low elevation areas, such as occurs in the Nisutlin Basin, then wolves can also be expected to be concentrated into smaller portions of their territory that overlap with these moose concentration areas.

The 1987 Nisutlin survey, small at only 5,083 km2, encompassed a moose wintering area concentration on the Nisutlin and Wolf rivers. This concentration of moose made it likely that non resident packs (the majority of their territory is outside the survey area) had a good chance of being counted in and, when added to the resident packs already present, would have inflated the pack density estimate.

The much larger 11, 446 km2 area surveyed in 2011 took in enough land area to minimize the chances of non resident packs being counted in after being drawn into the survey area by the winter moose concentrations.

The average pack size and wolf population density estimates determined for the Nisutlin Basin in 2011 are typical of many wolf populations surveyed in Yukon between 1984 and 2011 (Table 3). Pack density at 1.22 packs per 1,000 km2 is about 6% above the Yukon average, but still 23% lower than it was in the 1987 survey when it was estimated at 1.57 per 1,000 km2.

Table 3. Nisutlin 2011 and 1987 surveys compared to each other and to Yukon wolf population data averages.

	Number of surveys	*Average Area surveyed*	*Mean Pack Size*	*Wolves per 1,000 km2*	*Pack density*
2011 Nisutlin Survey	n/a	**11,446**	***6.4***	***8.6***	***1.22***
1987 Nisutlin Survey	n/a	5,083	*5.6*	*9.7*	*1.57*
Yukon Averages	29	12,167	*6.2*	*7.9*	*1.15*

The differences between the 1987 and 2011 Nisutlin survey data (Table 4) are interesting for the large decline in pack density that occurred between the 2 surveys.

Table 4. Wolf population changes in Nisutlin since the first survey estimate in 1987.

Year	*Pack density*	*Wolf density*	*Average Pack size*
1987	1.57	9.7	5.6
2011	1.22	8.6	6.4
2011 survey result	**Declined by 23%**	**Declined by 11%**	**Increased 13%**

We cannot say with certainty that the major decline in pack density from 1987 to 2011 was simply due to cancellation effect errors and amplification related to the small survey area. Because moose numbers are higher than in 1986 (Westover et. al In prep.) we assume that lower wolf numbers and pack density is not a result of a change in prey base (see below). The increased average pack size also tends to support the idea that the wolf population has responded in a neutral to positive manner as expected when exposed to an increasing prey base.

Packs, pack sizes and populations

Knowing the number of wolf packs in the area (measured as number of packs per 1,000 km2) and the average pack size is more useful in describing the state of the population than knowing the total number of individuals. The impact of wolf predation is more directly related to the number of packs than the number of animals in the pack. A pack of 10 wolves does not kill 5 times as much prey as a pack of 2 wolves. Five packs of 2 wolves will kill more prey than 10 wolves in one pack. Knowing how many packs and what the average pack size is in an area helps us to understand the dynamics of the predator prey system.

The ability of a wolf population to resist declining in number as its prey base declines is known as a lag effect. Wolf populations do not respond immediately to a declining prey base, but "lag" behind. When wolf populations finally do begin to respond it is with a drop in the average pack size because of reduced pup production and survival and increased dispersal of subdominants. Wolves are territorial and each pack maintains and protects an exclusive area for their own use. They usually respond aggressively to other wolves that are not pack members. The amount of area they protect is generally determined by social factors that are in effect over wide ranges of prey density and thus are only loosely linked to the amount of prey available. Wolves may persist and defend territories as reproductive pairs over long periods of time even when the prey base has declined to very low levels. Chronic long term low pup production or survival and continued high dispersal will eventually lead to a decline in the number of packs if the amount of prey in an area remains at low levels. When a pack disappears through the death of one or both alpha breeders with no surviving offspring, other packs in the area may absorb portions of the vacant territory and increase the amount of area they protect so they can incorporate more

ungulate biomass under their protected "umbrella", thus a decline in pack density occurs.

Pack membership can change dramatically from year to year because year to year differences in prey availability affects pup survival and dispersal rates. Even if we knew exactly how many wolves were in an area that number could change within a few months due to mortality and dispersal. Each pack may lose more than 20% of its members every year between reproduction cycles beginning in May. Therefore, to understand the predator prey dynamics in an area, knowing the number of packs and the trend with respect to pup production/survival and dispersal is more important than knowing the total number of wolves.

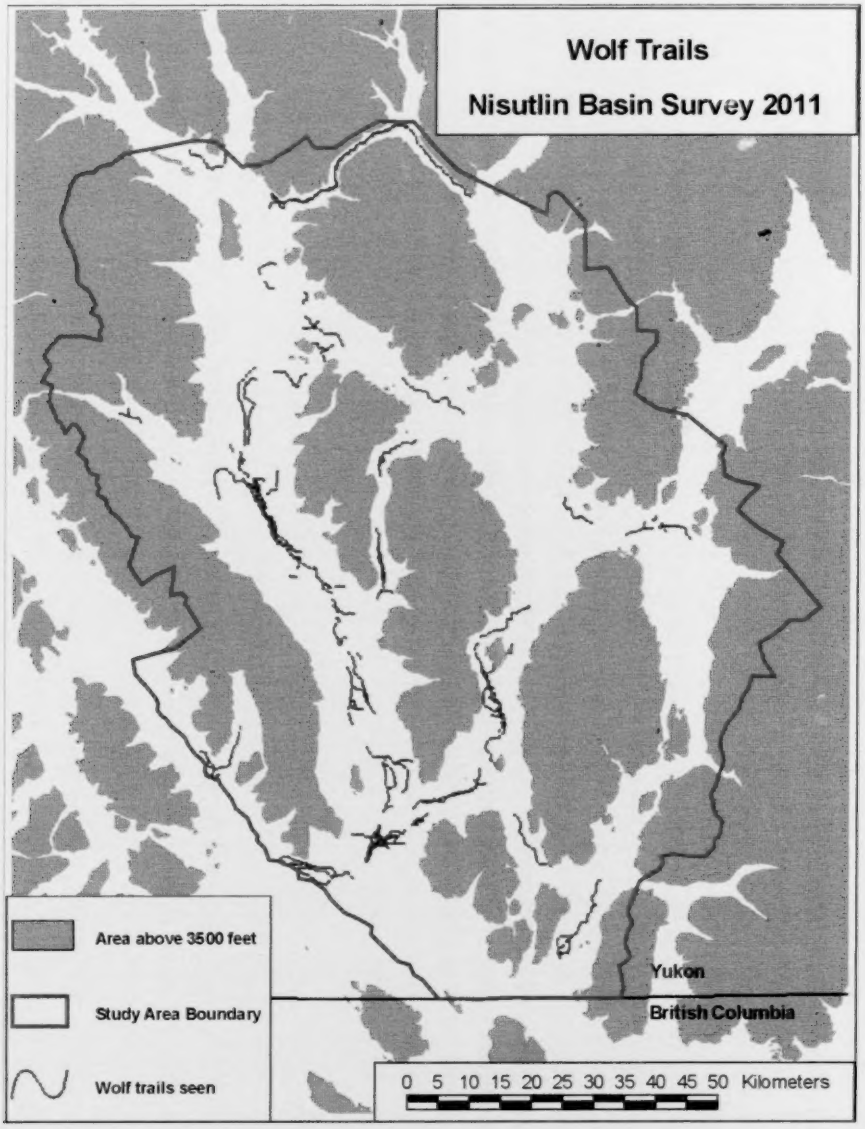
Reference

WESTOVER, S., K. O'DONOVAN, S. TAYLOR, AND R. WARD. In prep. Nisutlin South early winter moose survey, 2010. Yukon Fish and Wildlife Branch Technical Report, Whitehorse, Yukon, Canada.

Appendix 1. Flight times and down days for Teslin 2011 wolf survey

Date	*Hours Flown*	*Snow fall (cm)*	*Weather*	*mean daily temp*
5-Feb	5.8	0	Clear cold	-15
6-Feb	5.1	0	Clear cold	-16
7-Feb	7.1	0	Clear cold	-21
8-Feb	6.8	trace	Partial overcast cold	-25
9-Feb	0	0.5	Fog, low cloud, light snow	-14
10-Feb	0	2	Windy low lying cloud	-4
11-Feb	2.3	0	Clear warm windy	-4
12-Feb	4.3	trace	Overcast warm windy SE	-6
13-Feb	2.8	trace	Overcast winds variable	-16
14-Feb	0	0	High winds SE	-22
15-Feb	7.8	0	Clearing in afternoon, cold	-27
16-Feb	6.1	0	Clear cold	-31
17-Feb	7.0	0	Clear cold	-30
18-Feb	4.0	0	Clear cold	-29
18-Feb	4.0	0	Clear cold	-29

Appendix 2. Wolf activity as evidenced by wolf track sign in the study area.



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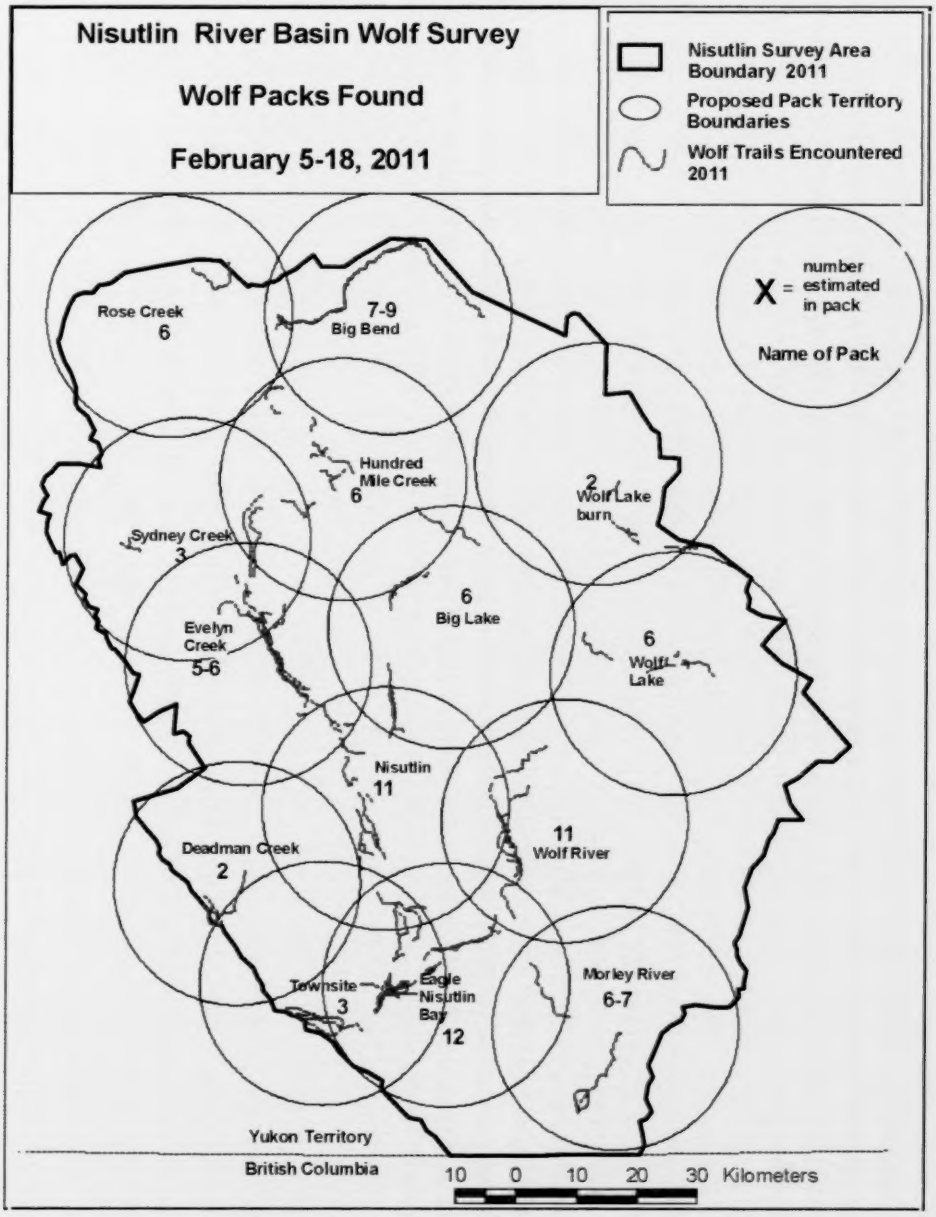

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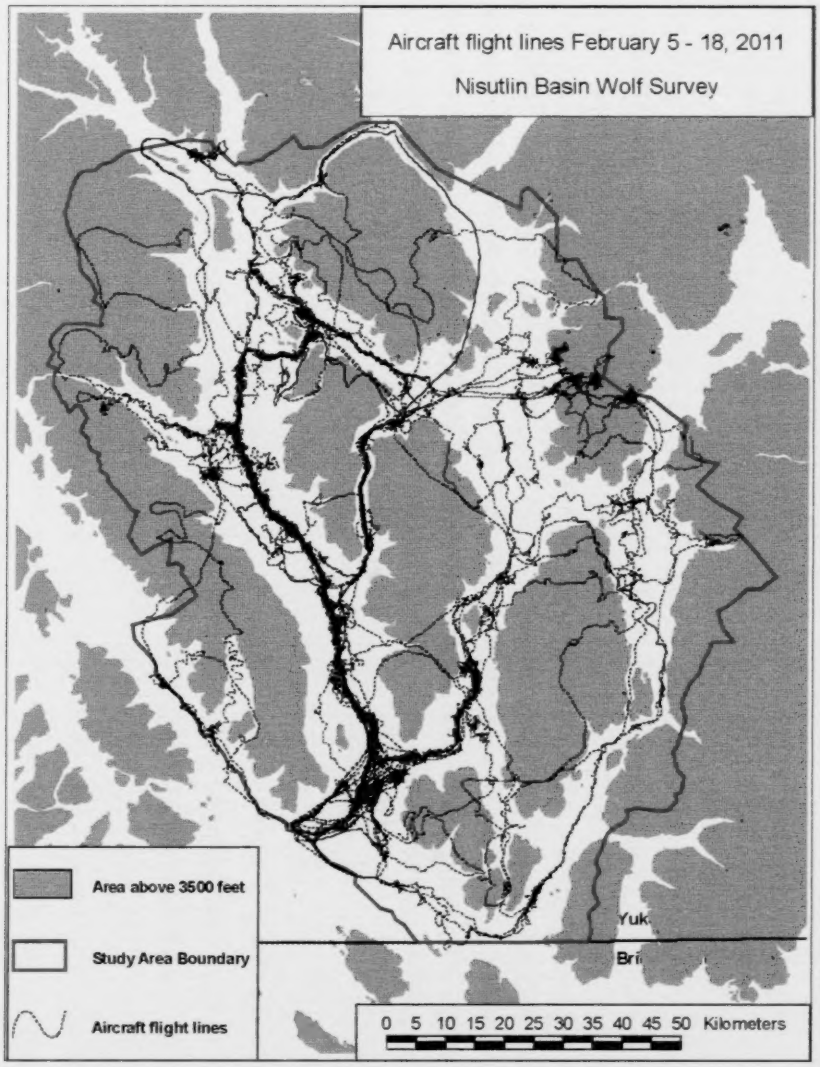
Aircraft flight lines February 5 - 18, 2011
Nisutlin Basin Wolf Survey
Area above 3500 feet
Study Area Boundary
Aircraft flight lines
0 5 10 15 20 25 30 35 40 45 50 Kilometers